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PHILOSOPHICAL  
TRANSACTIONS.

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- I. *An Account of the Discovery of the Manner of making Isinglass in Russia; with a particular Description of its Manufacture in England, from the Produce of British Fisheries. In a Letter from Humphrey Jackson, Esq; F. R. S. to William Watson, M. D. F. R. S.*

S I R,

Read Nov. 19, 1772. **Y**OUR distinguished zeal to promote science in general, and particularly such arts as tend to improve the commerce  
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of your country, incites me to address to you the following account of the genuine manufacture of foreign isinglass, with the method of making it in England from British materials. If you should judge the subject deserving attention, you will do me great honour in presenting this paper to the Royal Society: but this I beg leave to submit to your judgment and candour, and to subscribe myself,

With great esteem,

S I R,

Your most obliged,

and most obedient

humble servant,

Great Tower-Hill,  
June 15, 1772.

Humphrey Jackson.

**A**LL authors, who have hitherto delivered processes for making ichthyocola, fish-glue or isinglass, have greatly mistaken both its constituent matter and preparation.

To prove this assertion, it may not be improper to recite what Pomet says upon the subject, as he appears to be the principal author whom the rest have copied \*. After describing the fish, and referring to a cut engraved from an original in his custody, he says: ‘ As to the manner of making the isinglass, the finewy parts of the fish are boiled in water, till all of them be dissolved that will dissolve; then the gluey liquor is strained, and set to cool. Being cold, the fat is carefully taken off, and the liquor itself boiled to a just consistency, then cut to pieces, and made into a twist, bent in form of a crescent, as commonly sold, then hung upon a string, and carefully dried.’

From this account, it might be rationally concluded that every species of fish which contained gelatinous principles would yield isinglass: and this parity of reasoning seems to have given rise to the hasty conclusions of those, who strenuously vouch for the extraction of isinglass from sturgeon; but as that fish is easily procureable, the negligence of ascertaining the fact by experiment seems inexcusable.

Every traveller, as well as author, who mentions isinglass, observes that it is made from certain fish

\* See Pomet’s History of Drugs, and Caspar Neuman’s Chemistry, English translations. Hist. Matæ Medicæ, Vogel. Lewis’s Materia Medica. Doë’s Institutes of Chemistry.

found in the Danube and rivers of Muscovy. Willughby and others inform us, that it is made of the found of the \* Beluga; Caspar Newman that it is made of the *Huso Germanorum* and other fish, which he has seen frequently sold in the public markets of Vienna. These circumstances make it appear the more extraordinary, that a perfect account of the manufacture of such an essential article of commerce should remain so long unrevealed.

In my first attempts to discover the constituent parts and manufacture of isinglass, relying too much upon the authority of some chemical authors, whose veracity I had experienced in many other instances, I found myself constantly disappointed. Glue, not isinglass, was the result of every process; and although, in the same view, a journey to Russia proved fruitless, yet a steady perseverance in the research proved not only successful as to this object, but, in the pursuit to discover a resinous matter plentifully procureable in the † British fisheries, which has been found, by ample experience, to answer similar purposes. It is now no longer a secret that our ‡ lakes and rivers in North America are stocked

\* Vide Specimen Histör. Nat. Volg. Auctore J. R. Forster, Philof. Transf. 1767.

† Upwards of forty tons of British isinglass have been manufactured and consumed since this discovery was first made.

‡ As the lakes of North America lie nearly in the same latitude with the Caspian Sea, particularly Lake Superior, which is said to be of greater extent, it was conjectured they might abound with the same sorts of fish, and, in consequence of public advertisements distributed in various parts of North America, offering premiums for the sounds of sturgeon, and other fish, for the purpose of making isinglass, several specimens of fine  
with

with immense quantities of fish, said to be the same species with those in Muscovy, and yielding the finest isinglass, the fisheries whereof, under due encouragement, would doubtless supply all Europe with this valuable article.

But to return, no artificial heat is necessary to the production of isinglass, neither is the matter dissolved for this purpose ; for, as the continuity of its fibres would be destroyed by solution, the mass would become brittle in drying, and snap short asunder, which is always the case with glue, but never with isinglass. The latter, indeed, may be resolved into glue with boiling water, but its fibrous recomposition would be found impracticable afterwards, and a fibrous texture is one of the most distinguishing characteristics of genuine isinglass. The reproduction of leather might, with equal reason, be attempted from the former.

A due consideration that an imperfect solution of isinglass, called fining by the brewers, possessed a peculiar property of clarifying malt liquors, induced me to attempt its analysis in cold subacid menstruums. One ounce and a half of good isinglass, steeped a few days in one gallon of stale beer, was converted into good fining, of a remarkable thick consistence : the same quantity of glue, under similar treatment, yielded only a mucilaginous liquor, resembling diluted gum-water, which, instead of clarifying beer, increased both its tenacity and turbidness, and communicated other properties in no

isinglass, the produce of fish taken in these parts, have been lately sent to England, with proper attestations as to the unlimited quantity which may be procured.

respect

respect corresponding with those of genuine fining. On commixing three spoonfuls with a gallon of malt liquor, in a tall cylindrical glass, a vast number of curdly masses became presently formed, by the reciprocal attraction of the particles of isinglass and the feculencies of the beer, which, increasing in magnitude and specific gravity, arranged themselves accordingly, and fell in a combined state to the bottom, through the well-known laws of gravitation; for, in this case, there is no elective attraction, as some have imagined, which bears the least affinity with what frequently occurs in chemical decompositions.

These phenomena are adduced here as correlative proofs of the impracticability of making isinglass by the previous reduction of the finewy parts of fish into jelly; and it seems evident, that the clarifying action of isinglass depends principally upon a crude minute division, not solution of its parts, which is still farther confirmed, by diluting a few drops of fining with fair water in a glass; for thus the slender filaments become conspicuous to the eye, especially when assisted with a double convex lens, but these immediately disappear on an addition of hot water.

As the general processes for making isinglass appear from hence illusive and erroneous, the long concealed principles of its manufacture into the various common forms and shapes become more obvious and comprehensive. If what is commercially termed long or short stapled isinglass be steeped a few hours in fair cold water, the entwisted membranes will expand, and reassume their original beau-

ful \* hue, and, by a dextrous address, may be perfectly unfolded. By this simple operation, we find that isinglass is actually nothing more than certain membranous parts of fishes, divested of their native mucosity, rolled and twisted into the forms above-mentioned, and dried in the open air.

The sounds, or air-bladders of fresh-water fish, in general, are preferred for this purpose, as being the most transparent, flexible, delicate substances. These constitute the finest sorts of isinglass; those called book and ordinary staple, are made of the intestines, and probably the peritonæum, of the fish. The Beluga yields the greatest quantity, as being the largest and most plentiful fish in the Muscovy rivers; but the sounds of all fresh-water fish yield, more or less, fine isinglass, particularly the smaller sorts, found in prodigious quantities in the Caspian sea, and several hundred miles beyond Astracan, in the Wolga, Yaik, Don, and even as far as Siberia, where it is called *kle* or *kla* by the natives, which implies a glutinous matter; it is the basis of the Russian glue, which is preferred to all other kinds for its strength.

The anatomy and † uses of the sound in fish seems not yet adjusted by ichthyologists. I have not met with a genuine description of its situation and

\* If the fine transparent isinglass be held in certain positions to the light, it frequently exhibits beautiful prismatic colours.

† Fishermen have a dextrous art in perforating the sound of fresh-taken cod fish with a needle, in order to disengage the inclosed air. Without this operation, the fish could not be kept under water in the well-boat, consequently could not live; but if by accident the operator wounds an artery, the fish presently dies, through the discharge of blood, to the loss of the proprietor, who thus can seldom bring it sweet to market.

figure

figure in any author. A modern writer \* will have it to be the mesentery of the fish; but the celebrated Gouan, the latest, and perhaps the most accurate author on ichthyology, gives a more satisfactory and comprehensive account of it, under the title of † *La Vésicule Aérienne*. Yet, if the identity of the air-bladder, and what, in English, is called sound, be admitted, which seems particularly ascertained in a certain genus, viz. the *Asellus* of Willughby, or *Gadus* of Artedi, his description is a little erroneous with respect to its termination near the *Vesica urinaria*; for in cod and ling, the continuation of the sound, or air-bladder, may be easily traced from thence to the last *vertebra* adjoining the tail.

The sounds, which yield the finer isinglass, consist of parallel fibres, and are easily rent longitudinally; but the ordinary sorts are found composed of double membranes, whose fibres cross each other obliquely, resembling the coats of a bladder; hence the former are more readily pervaded and divided with subacid

\* Doffie, in Memoirs of Agriculture.

† La Vésicule aérienne est un sac membraneux composé de deux ou trois envelopes, qui se separent facilement, & rempli d'air, à la faveur duquel les poissons se soutiennent dans l'eau. Il est pour l'ordinaire situé en long, enfermé dans le peritoine, placé entre les vertebres & l'estomac. Sa longueur dépend de la capacité du bas ventre, & de la grandeur du poisson: il est tantôt cylindrique, elliptique, ové ou renversé, tantôt à deux lobes & à deux loges, tantôt à trois lobes & à trois loges, &c. dans les males il descend presque jusqu' à la region de la vessie urinaire.

Cette Vésicule est attachée avec l'estomac, avec l'œsophage, sans le diaphragme, tantôt par le côté tantôt par la pointe & s'y abbouche par un conduit pneumatique. Gouan, Histoire des Poissons.

liquors;

liquors; but the latter, through a peculiar kind of interwoven texture, are with great difficulty torn asunder, and long resist the power of the same menstruum; yet, when duly resolved, are found to act with equal energy in clarifying liquors.

Ifinglass receives its different shapes in the following manner.

The parts, of which it is composed, particularly the sounds, are taken from the fish while sweet and fresh, slit open, washed from their slimy *sordes*, divested of every thin membrane which envelops the sound, and then exposed to stiffen a little in the air. In this state, they are formed into rolls about the thickness of a finger, and in length according to the intended size of the staple: a thin membrane is generally selected for the center of the roll, round which the rest are folded alternately, and about half an inch of each extremity of the roll is turned inwards. The due dimensions being thus obtained, the two ends of what is called short staple are pinned together with a small wooden \* peg; the middle of the roll is then pressed a little downwards, which gives it the resemblance of a heart shape, and thus it is laid on boards, or hung up in the air to dry. The sounds, which compose the long staple, are larger than the former; but the operator lengthens this sort at pleasure, by interfolding the ends of one or more pieces of the sound with each other. The extremities are fastened with a peg, like the former; but the middle part of the roll is bent more considerably down-

\* See the annexed Drawings [TAB. I. Fig. 1.]

wards ; and, in order to preserve the \* shape of the three obtuse angles thus formed, a piece of round stick, about a quarter of an inch diameter, is fastened in each angle with small wooden pegs, in the same manner as the ends. In this state, it is permitted to dry long enough to retain its form, when the pegs and sticks are taken out, and the drying completed ; lastly, the pieces of isinglass are colligated in rows, by running packthread through the peg-holes, for convenience of package and exportation.

The membranes of the † book sort, being thick and refractory, will not admit a similar formation with the preceding : the pieces therefore, after their sides are folded inwardly, are bent in the center, in such manner that the opposite sides resemble the cover of a book, from whence its name ; a peg being run across the middle, fastens the sides together, and thus it is dried like the former. This sort is interleaved, and the pegs run across the ends, the better to prevent its unfolding.

That called cake isinglass is formed of the bits and fragments of the staple sorts, put into a flat metalline pan, with a very little water, and heated just enough to make the parts cohere like a pancake, when it is dried ; but frequently it is overheated, and such pieces, as before observed, are useless in the business of fining. Experience has taught the consumers to reject them.

Isinglass is best made in the summer, as frost gives it a disagreeable colour, deprives it of weight, and

\* See Fig. 3.

† Fig. 4.

impairs its gelatinous principles; its fashionable forms are unnecessary, and frequently injurious to its native qualities. It is common to find oily putrid matter and *exuviae* of insects between the implicated membranes, which, through the inattention of the cellar-man, often contaminate wines and malt liquors in the act of clarification. These peculiar shapes might, probably, be introduced originally with a view to conceal and disguise the real substance of isinglass, and preserve the monopoly; but, as the mask is now taken off, it cannot be doubted to answer every purpose more effectually in its \* native state, without any subsequent manufacture whatever, especially to the principal consumers, who hence will be enabled to procure sufficient supply from the British colonies. Until this laudable end can be fully accomplished, and as a species of isinglass, more easily producible from the marine fisheries, may probably be more immediately encouraged, it may be manufactured as follows.

The sounds of cod and ling bear great analogy with those of the *accipenser* genus of Linnæus and Artedi, and are in general so well known, as to require no particular description. The Newfoundland and Iceland fishermen split open the fish, as soon as taken, and throw the back-bones, with the sounds annexed, in a heap; but, previous to incipient putrefaction, the sounds are cut out, washed from their slimes, and salted for use. In cutting out the sounds, the intercostal parts are left behind, which are much the best; the Iceland fishermen are so sensible of

\* See Fig. 5.

this, that they beat the bone upon a block with a thick stick, till the pockets, as they term them, come out easily, and thus preserve the sound entire. If the sounds have been cured with salt, that must be dissolved by steeping them in water, before they are prepared for isinglass; the fresh sound must then be laid upon a block of wood, whose surface is a little elliptical, to the end of which a small hair brush is nailed, and with a \* saw-knife, the membranes on each side of the sound must be scraped off. The knife is rubbed upon the brush occasionally, to clear its teeth; the pockets are cut open with scissars, and perfectly cleansed of the mucous matter with a coarse cloth: the sounds are afterwards washed a few minutes in lime-water, in order to absorb their oily principle, and lastly in clear water. They are then laid upon nets, to dry in the air; but, if intended to resemble foreign isinglass, the sounds of cod will only admit of that called book, but those of ling both shapes. The thicker the sounds are, the better the isinglass, colour excepted; but that is immaterial to the brewer, who is its chief consumer.

This isinglass resolves into fining, like the other sorts, in subacid liquors, as stale beer, cyder, old hock, &c. and in equal quantities produces similar effects upon turbid liquors, except that it falls speedier and closer to the bottom of the vessel, as may be demonstrated in tall cylindrical glasses; but foreign isinglass retains the consistency of fining preferably in warm weather, owing to the greater tenacity of its native mucilage.

\* See Fig. 2.

Vegetable acids are, in every respect, best adapted to fining: the mineral acids are too corrosive, and even insalubrious in common beverage

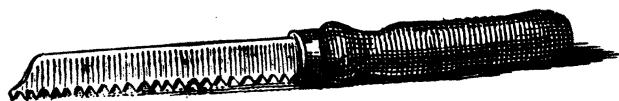
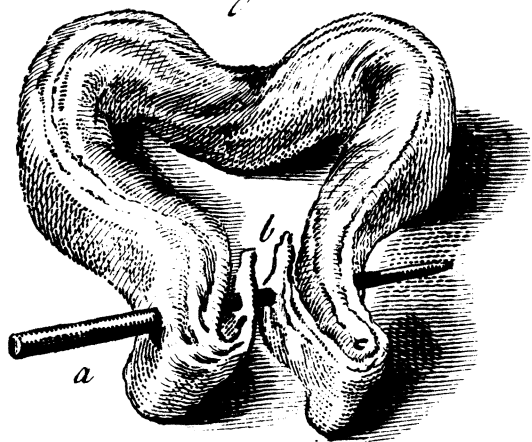
It is remarkable that, during the conversion of isinglass into fining, the acidity of the menstruum seems greatly diminished, at least to taste, not on account of any alkaline property in the isinglass, probably, but by its enveloping the acid particles. It is likewise reducible into jelly with alkaline liquors, which indeed are solvents of all animal matters; even cold lime-water dissolves it into a pulpy *magma*. Notwithstanding this is inadmissible as fining, on account of the menstruum, it produces an admirable effect in other respects: for, on commixture with compositions of plaster, lime, &c. for ornamenting walls exposed to vicissitudes of weather, it adds firmness and permanency to the cement; and if common brick-mortar be worked up with this jelly, it soon becomes almost as hard as the brick itself: but, for this purpose, it is more commodiously prepared, by dissolving it in cold water, acidulated with vitriolic acid; in which case, the acid quits the jelly, and forms with the lime a *selenitic* mass, while, at the same time, the jelly being deprived, in some measure, of its moisture, through the formation of an indissoluble concrete amongst its parts, soon dries, and hardens into a firm body; whence its superior strength and durability are easily comprehended.

It has long been a prevalent opinion, that surgeon, on account of its cartilaginous nature, would yield great quantities of isinglass; but, on examination, no part of this fish, except the inner coat of the sound, promised the least success. This being full  
of

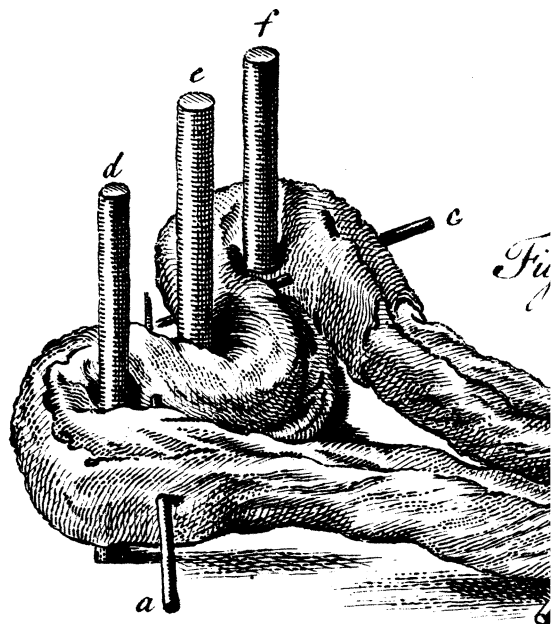
of *rugæ*, adheres so firmly to the external membrane, which is useless, that the labour of separating them supercedes the advantage. The intestines, however, which in the larger fish extend several yards in length, being cleansed from their mucus, and dried, were found surprizingly strong and elastic, resembling cords made with the intestines of other animals, commonly called cat-gut, and, from some trials, promised superior advantages, when applied to mechanic operations.

Having now sufficiently revealed the principal *arcana* in the manufacture of isinglass, and explained some of its least known phenomena and properties, the farther prosecution thereof, as a commercial business, is left to others, whose future inquiries into the subject, it is hoped, will, in some respect, be anticipated through this narrative; but whatever success may attend the attempt, I flatter myself to stand acquitted, in having contributed every thing in my power to its advancement and perfection.

*Fig. 1.*

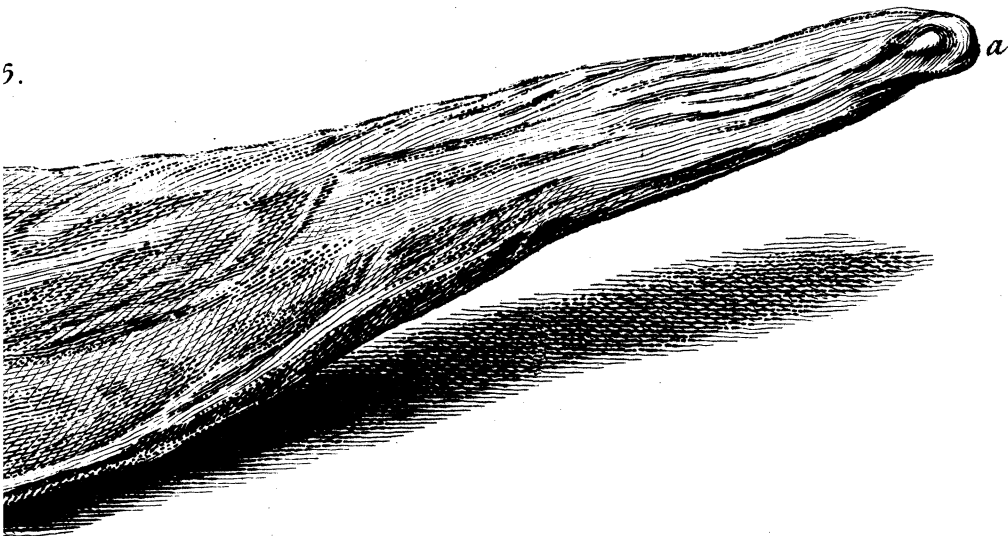
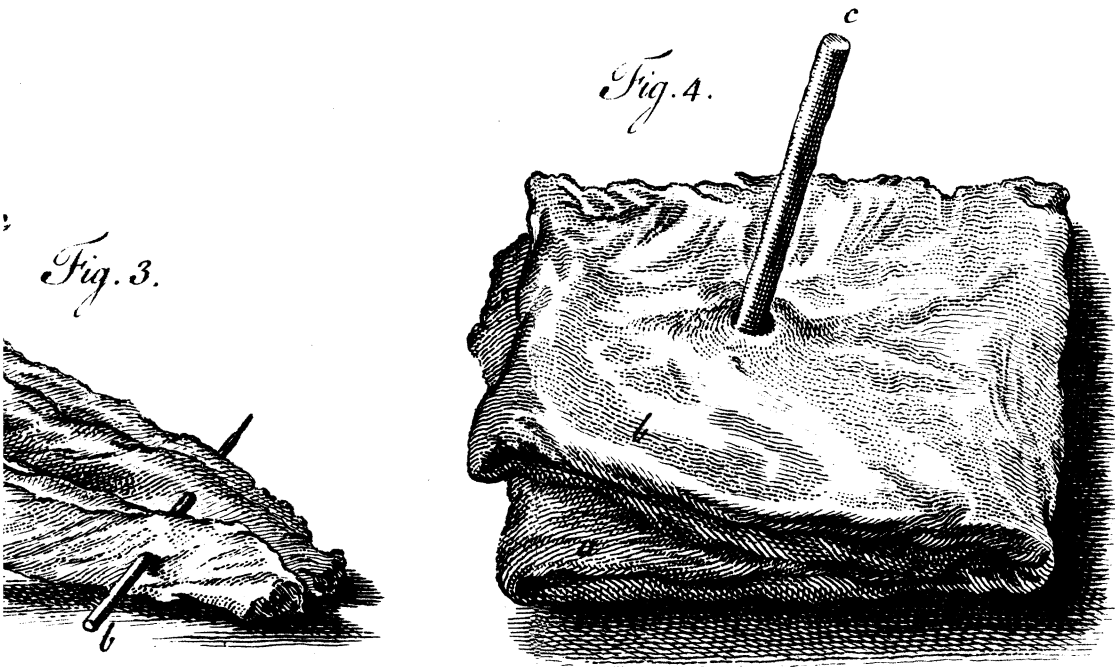


*Fig. 2.*



*Fig. 5.*





EXPLANATION of the Figures ; TAB. I.

- Fig. 1. Short staple ifinglafs.  
*a* The wooden peg, which fastens the two ends of the ifinglafs.  
*b* The extremities folded inwards.
- Fig. 2. The saw-knife.
- Fig. 3. Long staple ifinglafs.  
*a b c* Wooden pegs or pins.  
*d e f* Three round sticks, or pieces of wood, fastened in the angles of the ifinglafs by the pins *a* and *c*.
- Fig. 4. Book ifinglafs.  
*a b* The two fides, which resemble the cover of a book.  
*c* The wooden pin run through the fides, to fasten them together.
- Fig. 5. The entire found, or *vesica aeria*, of the ifinglafs fish dried in its natural state.  
*a* The hole made for the packthread, where-with it is hung up to dry.  
*b* The orifice of part of the pneumatic vessels left with the found.

Fig. 1.

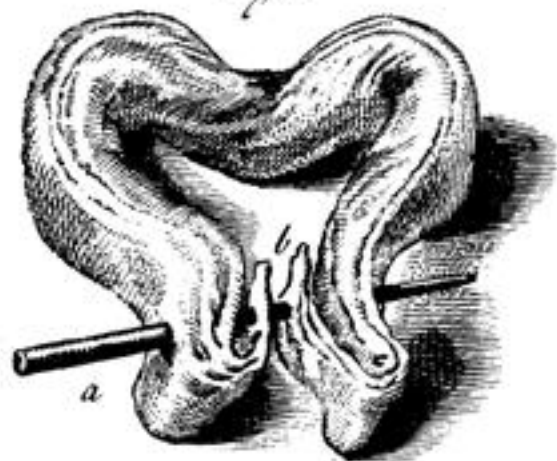


Fig. 2.

Fig. 3.

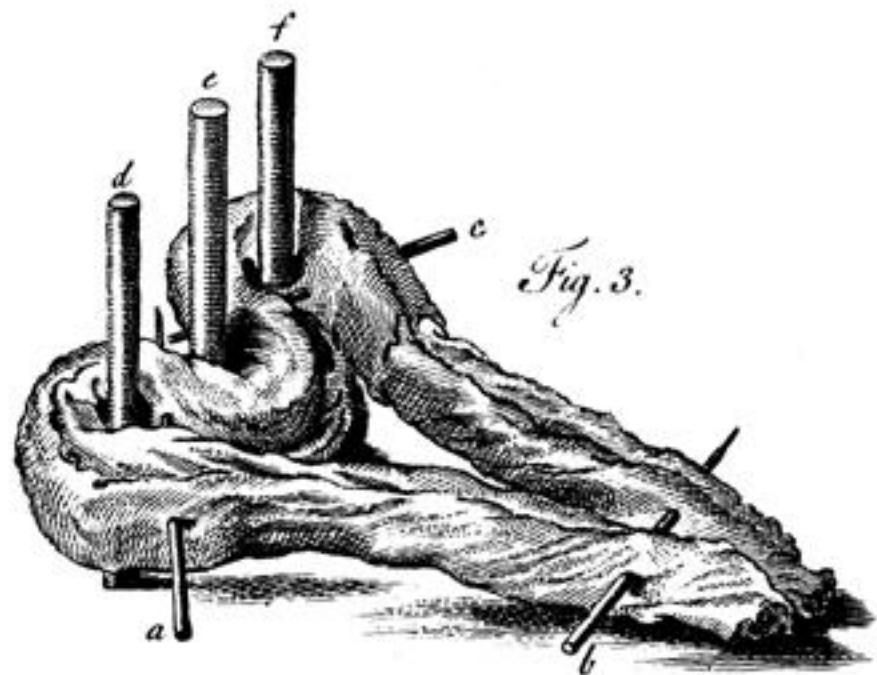


Fig. 4.

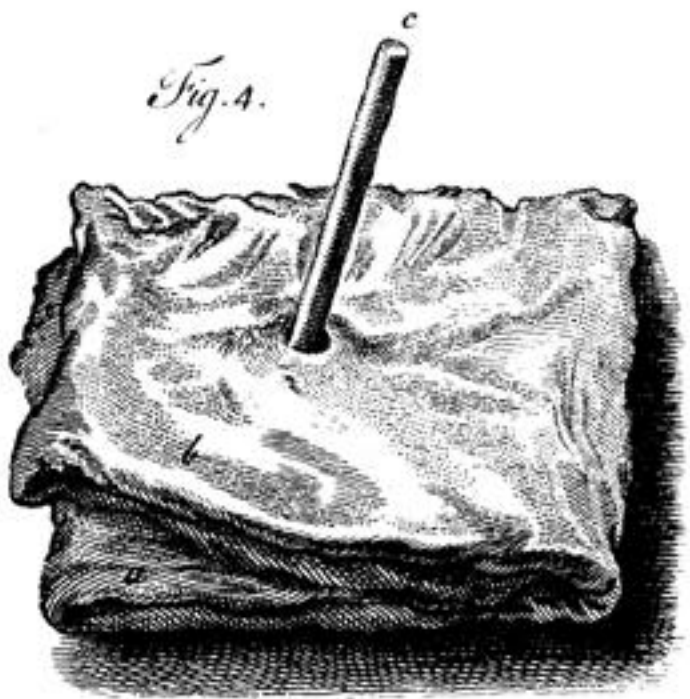


Fig. 5.

